Amendments to the Specification

The below paragraphs will replace all prior versions of the paragraphs.

[0047] Array of individually controllable elements 104 ~~114~~ (e.g., a programmable mirror array) can be used for applying a pattern to the projection beam 110. In general, the position of the array of individually controllable elements 104 ~~114~~ can be fixed relative to projection system 108. However, in an alternative arrangement, an array of individually controllable elements 104 ~~114~~ may be connected to a positioning device (not shown) for accurately positioning it with respect to projection system 108. As here depicted, individually controllable elements 104 ~~114~~ are of a reflective type (e.g., have a reflective array of individually controllable elements).

[0049] Projection system (e.g., a lens) 108 (e.g., a quartz and/or CaF2 lens system or a catadioptric system comprising lens elements made from such materials, or a mirror system) can be used for projecting the patterned beam received from beam splitter 118 onto a target portion C 120 (e.g., one or more dies) of the substrate 114. The projection system 108 may project an image of the array of individually controllable elements 104 ~~114~~ onto the substrate 114. Alternatively, the projection system 108 may project images of secondary sources for which the elements of the array of individually controllable elements 104 ~~114~~ act as shutters. The projection system 108 may also comprise a micro lens array (MLA) to form the secondary sources and to project microspots onto the substrate 114.

[0050] The source 112 (e.g., an excimer laser) can produce a beam of radiation 122. This beam 122 is fed into an illumination system (illuminator) IL 124, either directly or after having traversed conditioning device 126, such as a beam expander Ex, for example. The illuminator 124 may comprise adjusting device AM 128 for setting the outer and/or inner radial extent (commonly referred to as σ-outer and σ-inner, respectively) of the intensity distribution in the beam 122. In addition, it will generally comprise various other components, such as an integrator IN 130 and a condenser CO 132. In this way, the beam 110 impinging on the array of individually controllable elements 104 ~~114~~ has a desired uniformity and intensity distribution in its cross section.

[0052] The beam 110 subsequently intercepts the array of individually controllable elements 104 ~~114~~ after being directing using beam splitter 118. Having been reflected by the array of individually controllable elements 104 ~~114~~, the beam 110 passes through the projection system 108, which focuses the beam 110 onto a target portion 120 of the substrate 114.

[0053] With the aid of the positioning device 116 (and optionally interferometric measuring device IF 134 on base plate BP 136 that receives interferometric beams 138 via beam splitter 140), the substrate table 106 can be moved accurately, so as to position different target portions 120 in the path of the beam 110. Where used, the positioning device for the array of individually controllable elements 104 ~~114~~ can be used to accurately correct the position of the array of individually controllable elements 104 ~~114~~ with respect to the path of the beam 110, e.g., during a scan. In general, movement of the object table 106 is realized with the aid of a long-stroke module (course positioning) and a short-stroke module (fine positioning), which are not explicitly depicted in Figure 1. A similar system may also be used to position the array of individually controllable elements 104 ~~114~~. It will be appreciated that the projection beam 110 may alternatively/additionally be moveable while the object table 106 and/or the array of individually controllable elements 104 ~~114~~ may have a fixed position to provide the required relative movement.

[0056] The depicted apparatus 100 can be used in four preferred modes:

[0057] 1. Step mode: the entire pattern on the array of individually controllable elements 104 ~~114~~ is projected in one go (i.e., a single "flash") onto a target portion 120. The substrate table 106 is then moved in the x and/or y directions to a different position for a different target portion 120 to be irradiated by the beam 110.

[0058] 2. Scan mode: essentially the same as step mode, except that a given target portion 120 is not exposed in a single "flash." Instead, the array of individually controllable elements 104 ~~114~~ is movable in a given direction (the so-called "scan direction", e.g., the y direction) with a speed v, so that the projection beam 110 is caused to scan over the array of individually controllable elements 104 ~~114~~. Concurrently, the

substrate table 106 is simultaneously moved in the same or opposite direction at a speed V = Mv, in which M is the magnification of the projection system 108. In this manner, a relatively large target portion 120 can be exposed, without having to compromise on resolution.

[0059] 3. Pulse mode: the array of individually controllable elements 104 ~~114~~ is kept essentially stationary and the entire pattern is projected onto a target portion 120 of the substrate 114 using a pulsed radiation system 102. The substrate table 106 is moved with an essentially constant speed such that the projection beam 110 is caused to scan a line across the substrate 106. The pattern on the array of individually controllable elements 104 ~~114~~ is updated as required between pulses of the radiation system 102 and the pulses are timed such that successive target portions 120 are exposed at the required locations on the substrate 114. Consequently, the projection beam 110 can scan across the substrate 114 to expose the complete pattern for a strip of the substrate 114. The process is repeated until the complete substrate 114 has been exposed line by line.

[0060] 4. Continuous scan mode: essentially the same as pulse mode except that a substantially constant radiation system 102 is used and the pattern on the array of individually controllable elements 104 ~~114~~ is updated as the projection beam 110 scans across the substrate 114 and exposes it.